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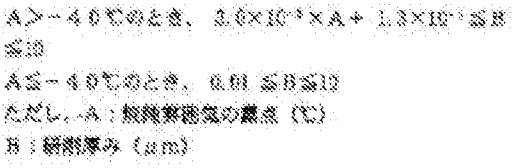
(54) PRODUCTION OF COLD ROLLED FERRITIC STAINLESS STEEL STRIP

(57)Abstract:

PURPOSE: To stabilize the productivity of a highly corrosion resistant steels strip by annealing a cold rolled low-carbon ferritic chromium stainless steel sheet in a reducing atmosphere controlled in dew point and mechanically grinding the surface layers thereof under the specified conditions corresponding to the dew point thereof, then subjecting the steel sheet to an electrolytic treatment.



CONSTITUTION: The cold rolled stainless steel sheet having a steel compsn. contg., by weight, ≤0.02% e, 0.3 to 3.0% Si, ≤1.0% Mn, ≤0.05% P, ≤0.02% S, 10 to 25% Cr, ≤0.02% N, ≤0.008% O and ≤0.5% Al and consisting of the balance Fe and inevitable impurities is annealed in a reducing atmosphere which consists of an inert gas contg. 20vol.% H2 and is kept at the dew point -10°C or below. The surface layers of the thickness satisfying equation I are then mechanically ground according to the dew point of the

inert gas. The steel sheet is thereafter subjected to an electrolytic treatment under conditions of a temp. of 38 to 65°C and current density of 1 to 30A/dm2 in a nitric acid soln. having a liquid compsn. of a nitric acid concn. of 10 to 300g/l and nitric acid concn. of 1 to 30g/l.

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the manufacturing method of the ferrite series stainless steel cold-rolled steel strip which has the characteristic excellent in the corrosion resistance after descaling while making possible descaling which started the manufacturing method of the stainless steel cold-rolled steel strip (a steel plate is also included), especially was stabilized.
[0002]
[Description of the Prior Art]Generally, annealing is given to the stainless steel after cold rolling in order to secure processability and corrosion resistance. There are the method of processing by a strong reducing atmosphere and the method of processing by a combustion atmosphere in the main annealing technique of ferritic stainless steel. The former method is called bright-annealing (BA) processing, an oxide film (scale) is very thin and gloss with almost rolling is acquired. On the other hand, since the scale more than thickness fixed at the time of annealing arises by the latter method, the way things stand, it has an adverse effect on corrosion resistance, the dice life at the time of shaping and processing, etc. For this reason, when it anneals by a combustion atmosphere, pickling treatment for descaling is performed after annealing. The annealing technique which carries out high-speed plate leaping is being tried in a reducing atmosphere like the continuous annealing line (CAL) of plain steel in recent years. In this case, since it contained Cr which oxidizes easily, even if ferritic stainless steel was an atmosphere which does not oxidize, the temper color-like scale generated it on the surface and it needed descaling treatment for it after annealing at plain steel.
[0003]By the way, generally the method of combining the process of being immersed in acid solutions, such as sulfuric acid, nitric acid, and nitric-hydrofluoric acid, or carrying out electrolytic treatment was conventionally adopted as descaling treatment performed after

annealing after processes, such as salt processing immersed in melting alkali salt, or electrolytic treatment in a neutral salt solution. The concrete method is indicated by JP,S38-12162,B, JP,S59-59900,A, or stainless steel manual (Masayoshi Hasegawa editorial supervision, Nikkan Kogyo Shimbun, 1973, P.839), for example. In addition, the art electrolyzed in a nitrohydrochloric-acid solution is indicated by JP,H1-147100,A, JP,4-66699,A, etc. as a method which simplified the process more. The actual condition was that these methods are properly used with the difficulty of descaling resulting from a steel type or annealing conditions. However, even if it performs descaling treatment of the above processes, in order to remove a scale layer, the corrosion resistance after removing a scale layer the processing covering a long time being not only required, but was not enough, and was unstable.

[0004]

[Problem(s) to be Solved by the Invention]Thus, each above-mentioned known art had the problem remarkably especially with insufficient corrosion resistance after descaling with the low productivity of a descaling process to say. The main purpose of this invention is to provide the manufacturing method of the stainless steel cold-rolled steel strip which does not cause the problem in which annealing and the above-mentioned conventional technology at the time of carrying out descaling are holding the stainless steel cold-rolled steel strip, and which was mentioned above. Other purposes of this invention have high productivity and the descaling capability to have been stabilized, and there are in providing the manufacturing method of the stainless steel cold-rolled steel strip provided with the corrosion resistance outstanding moreover.

[0005]

[Means for Solving the Problem]Now, artificers investigated relation with corrosion resistance in detail while observing first the surface of a steel plate which carried out pickling at the conventional process after annealing towards realization of the purpose of upper **. . As a result, in a steel sheet surface after pickling, oxides which cannot be checked visually, such as a little Si, aluminum, Ti, Nb, and Mo, remain near the interface with a ferrite, and if these elements exist in the state of dissolution in steel, they will raise corrosion resistance. When it remained on the surface in the state of an oxide, that became a rusting starting point and found out degrading corrosion resistance. It turned out that these oxides cannot carry out dissolution removal only by chemical processing for a short time, but it condenses to a layer part in order that other elements may dissolve selectively rather. Then, while corrosion-resistant improvement was aimed at by grinding this portion mechanically and removing it, knowledge that stable and highly efficient descaling also became possible was acquired. In an annealing process, oxides, such as the above-mentioned Si, aluminum, Ti, Nb, Mo, etc. which degrade corrosion resistance, condensed, were formed near the interface with a ferrite, and an

oxide carried out the knowledge also of the depth also changing with annealing conditions from the existence surface.

[0006]This invention is completed based on the above-mentioned knowledge, and the gist composition is as follows.

(1) Less than C:0.02wt%, Si:0.3 - 3.0 wt%, Mn: Less than 1.0 wt%, less than P:0.05wt%, and less than S:0.02wt%. Cr: 10 - 25wt%, less than N:0.02wt%, and less than O:0.008 wt%. Contain less than aluminum:0.5 wt% and the remainder a cold-rolled steel strip of steel composition which consists of Fe and inevitable impurities, Gas composition consists of less than H_2:20 vol% and remainder:inactive gas, and the dew point anneals in a reducing atmosphere which is less than -10 **, and, subsequently according to said dew point At the time of following formula:A>-40 **. $3.0x10^{-3}$xA+ They are 0.01<=B<=10, however the dew point (**) of A:annealing atmosphere the time of $1.3x10^{-1}$<=B<=10A<=-40 **.

B: grinding thickness (micrometer)

Grind a surface layer of thickness to satisfy mechanically and liquid composition after that Nitric-acid-concentration:10-300 (g/l), Hydrochloric acid concentration: A manufacturing method of a ferrite series stainless steel cold-rolled steel strip, wherein current density performs electrolytic treatment on condition of 1-30 (A/dm^2) into a nitrohydrochloric-acid solution whose 1-30 (g/l) and solution temperature are 35-65 **.

[0007]To a thing of steel composition given in the above (1), further (2) Ti:0.1 - 1.0 wt%, Nb: 0.1 - 2.0 wt% and Mo:0.3 - 5.0 wt%, Cu: 0.3 - 1.0 wt% and nickel:0.1 - 1.0 wt%, A cold-rolled steel strip of an ingredient which makes it come to contain one sort chosen from Co:0.1 - 2.0 wt% of inside, or two sorts or more W:0.1 - 1.0 wt%, Gas composition consists of less than H_2:20 vol% and remainder:inactive gas, and the dew point anneals in a reducing atmosphere which is less than -10 **, and, subsequently according to said dew point At the time of following formula:A>-40 **. $3.0x10^{-3}$xA+ They are 0.01<=B<=10, however the dew point (**) of A:annealing atmosphere the time of $1.3x10^{-1}$<=B<=10A<=-40 **.

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[0008]To a thing of steel composition the above (1) or given in (2), further (3) Ca:0.003 - 0.02wt%, A cold-rolled steel strip of an ingredient which makes it come to contain B:0.0005 - 0.01wt% of one sort [any], or two sorts, Gas composition consists of less than H_2:20 vol%

and remainder:inactive gas, and the dew point anneals in a reducing atmosphere which is less than -10 **, and, subsequently according to said dew point At the time of following formula:A>-40 **. $3.0x10^{-3}xA+$ They are 0.01<=B<=10, however the dew point (**) of A:annealing atmosphere the time of $1.3x10^{-1}$<=B<=10A<=-40 **.

B: grinding thickness (micrometer)

Grind a surface layer of thickness to satisfy mechanically and liquid composition after that Nitric-acid-concentration:10-300 (g/l), Hydrochloric acid concentration: A manufacturing method of a ferrite series stainless steel cold-rolled steel strip, wherein current density performs electrolytic treatment on condition of 1-30 (A/dm^2) into a nitrohydrochloric-acid solution whose 1-30 (g/l) and solution temperature are 35-65 **.

[0009]

[Function]First, the Reason which limited the component composition of the ferrite series stainless steel cold-rolled steel strip kicked to this invention is explained.

C: Since Cr and carbide are generated, this deposits in a grain boundary and less than 0.02wt%C degrades corrosion resistance, as low its one as possible is desirable, but it uses less than 0.02wt% from restrictions of manufacturability.

[0010]and also it is added as an Si:0.3-3.0wt% deoxidizer -- more than 0.3wt% -- when it adds, it is an element which raises corrosion resistance remarkably. however -- since processability, weldability, and the descaling nature after annealing will be degraded if it adds so much -- Si -- 0.3 - 3.0wt% -- it may be 0.3 - 1.5wt% preferably.

[0011]although its lower one in the ability to do is desirable since less than Mn:1.0wt%Mn generates a sulfide in steel and degrades corrosion resistance -- less than 1.0wt% from restrictions of manufacturability -- less than 0.5wt% is used preferably.

[0012]P: Since less than 0.05wt%P reduces hot-working nature, it is an element with the lower desirable one in the ability to do.

0. less than 05wt% -- use less than 0.03wt% preferably.

[0013]since less than S:0.02wt%S generates Mn and a sulfide, and degrades corrosion resistance and degrades hot-working nature, as low its one as possible is desirable -- less than 0.02wt% -- less than 0.01wt% is used preferably.

[0014]Cr: When less than 10-20wt%Cr secures the corrosion resistance of stainless steel, it is a required basic element. In order to make a firm passive film generate, it needs to be added beyond 10wt%, but since the effect is saturated and there are also restrictions of manufacturability even if it exceeds addition 25wt%, it is considered as 10 - 25wt% of the range.

[0015]since less than N:0.02wt%N reacts to Cr, deposits in a grain boundary as a nitride and

degrades corrosion resistance, as low its one as possible is desirable -- less than 0.02wt% -- less than 0.1wt% is used preferably.

[0016]O: Since less than 0.008wt%O remains in steel as nonmetallic inclusion at the time of coagulation and degrades corrosion resistance, as low its one as possible is desirable. since the adverse effect will become remarkable if especially 0.008wt% is exceeded -- less than 0.008wt% -- less than 0.005wt% is used preferably.

[0017]aluminum: Although added as deoxidation material, less than 0.5wt%aluminum uses less than 0.5wt% in order to degrade processability, if it adds so much.

[0018]The following ingredient can be added if needed in addition to each of above-mentioned ingredients.

Ti: 0.1-1.0wt%Ti fixes C and N which remained in steel, it is an element effective for preventing grain boundary erosion, and the effect shows up at more than 0.1wt%. however, since hot-working nature will be degraded if it is so much alike and adds, it may be 0.1 - 1.0wt%. It is effective if the 8 or more-time abbreviation of C and the amount of N adds preferably.

[0019]Nb: 0.1-2.0wt%Nb fixes like Ti C and N which remained in steel, it is an element effective for preventing grain boundary erosion, and the effect shows up at more than 0.1wt%. however, since hot-working nature will be degraded if it is so much alike and adds, it may be 0.1 - 2.0wt%. It is effective if the 8 or more-time abbreviation of C and the amount of N adds preferably.

[0020]Mo: 0.3-5.0wt%Mo is an ingredient effective in raising the corrosion resistance of stainless steel.

0. more than 3wt% -- if it adds, it is effective, but if it adds so much, since processability and the toughness of a weld zone will be reduced, it may be 5.0wt%.

The desirable range is 0.5 - 3.0wt%.

[0021]Cu: Although 0.3-1.0wt%Cu is an element which raises pitting-proof nature, since martensite will arise and corrosion resistance will be degraded if it adds so much, add it in 0.3 - 1.0wt% of the range.

[0022]nickel: Although 0.1-1.0wt%nickel is an element which raises corrosion resistance, since martensite will arise and corrosion resistance will be degraded if it adds so much, add it in 0.1 - 1.0wt% of the range.

[0023]W: Although 0.1-1.0wt%W is an element which raises corrosion resistance, since corrosion resistance will be degraded on the contrary if it adds so much, add it in 0.1 - 1.0wt% of the range.

[0024]Co: Although 0.1-2.0wt%Co is an element which raises corrosion resistance, since martensite will arise and corrosion resistance will be degraded if it adds so much, add it in 0.1 - 2.0wt% of the range.

[0025]since Ca:0.003-0.02wt%Ca will degrade hot-working nature conversely if it adds so

much although it is an element which raises hot-working nature -- 0.003 - 0.02wt% -- less than 0.005-0.015wt% is used preferably.

[0026]since B:0.0005-0.01wt%B will degrade weldability and hot-working nature if it adds so much although it is an element which raises hot-working nature and intensity -- 0.0005 - 0.01wt% -- less than 0.001-0.005wt% is used preferably.

[0027]Next, in this invention, the Reason which limited annealing and descaling conditions is explained. It is necessary to make the annealing atmosphere of this invention into a reducing atmosphere. The thickness of the scale generated on the surface of the stainless steel band annealed in the continuous annealing line (CAL) etc. and the degree of concentration of each element in the interface of a ferrite and a scale receive large influence by a presentation and the dew point of an annealing atmosphere. That is, if the dew point of a reducing atmosphere becomes higher than -10 **, a generation scale will become thick and the degree of concentration of an element which degrades descaling nature, such as Si in the interface of a ferrite and a scale, aluminum, Ti, Nb, and Mo, and the corrosion resistance after pickling will become large. therefore -- a scale becomes thick too much and sufficient -- a ferrite -- concentration of these elements -- if a degree becomes excessive, even if it performs mechanical grinding at a next process, it will become difficult to carry out descaling treatment in a high-speed short time. moreover -- if the H_2 concentration in an annealing atmosphere is high -- a scale and concentration -- although a layer becomes thin, it is saturated near 20 vol%. If H_2 concentration becomes high too much, it will become disadvantageous from a point of safety and cost. therefore, the conditions of an annealing atmosphere -- less than H_2:20 vol% and dew point:-10 ** or less is preferably made into dew point:-25--45 ** H_2:2 - 10 vol%.

[0028]It continues at the above-mentioned annealing and mechanical grinding is performed. Mechanical grinding in this invention means the thing of mechanical grinding processing using a brush roll, abrasive powder, shot blasting, etc. Oxides, such as Si, aluminum, Ti, Nb, and Mo, remained on the surface, and these elements had condensed to the ferrite layer part, and artificers traced that these were degrading descaling nature and corrosion resistance, as a result of investigating the steel sheet surface after pickling in detail at the conventional process, as mentioned above. Then, when only predetermined thickness carries out grinding removal mechanically from steel strip surfaces, the surface state of the steel strip after annealing can be maintained uniformly, and it becomes possible to aim at stability of descaling, and corrosion-resistant improvement. The portion which degrades the corrosion resistance of a steel plate is removable by poor solubility by this mechanical grinding in the nitrohydrochloric-acid solution of post processes, such as Si of the ferrite interface which condensed at the time of annealing, aluminum, Ti, Nb, and Mo. By these operations, compared with the former, descaling treatment can be carried out to a high-speed short time, and the

corrosion resistance of the steel plate after pickling also improves.

[0029]What is necessary is just to perform the mechanical grinding amount (thickness) in this invention in the range shown with a following formula.

It is $3.0x10^{-3}$xA+ the time of A>-40 **. They are 0.01<=B<=10, however the dew point (**) of A:annealing atmosphere the time of $1.3x10^{-1}$<=B<=10A<=-40 **.

B: Grinding thickness (micrometer)

Having defined the grinding amount like an upper type depending on the dew point of an annealing atmosphere is based on the following Reason. namely, an artificer etc. -- concentration of each elements, such as scale thickness, Si of a ferrite, aluminum, Ti, Nb, and Mo,, as a result of investigating the influence of the annealing conditions exerted on a layer, In the annealing temperature of 1050 ** or less applied to the usual operation. scale thickness and concentration -- depending for layer thickness on the dew point of an annealing atmosphere greatly -- this concentration -- in the reducing atmosphere, in beyond dew point-40 **, the thickness from the surface of a layer was proportional to the dew point mostly, and found out becoming the thickness of about 1 law regardless of the dew point below -40 **. This fact was based and the minimum of the above-mentioned formula was defined. if a grinding amount becomes less than this range -- concentration of each scale or above-mentioned element -- a layer remains, descaling nature deteriorates, it becomes impossible to perform stable descaling, these elements remain also after pickling, and corrosion resistance is degraded. On the other hand, since the surface will be ruined and problems, such as sparks generating, will also be produced at the time of grinding if a grinding amount exceeds 10 micrometers, the maximum of a grinding amount shall be 10 micrometers.

[0030]Pickling is performed in a nitrohydrochloric-acid solution after the above-mentioned mechanical grinding. Artificers found out that the method of processing in a nitrohydrochloric-acid solution was suitable, as a result of processing the steel plate after grinding in various solutions about the treating solution after grinding from a viewpoint of the removal nature of ** mechanical grinding crack, and short time processing ** of the smooth nature secured ** passivation treatment on the surface of **. And as processing in a nitrohydrochloric-acid solution, it is required in the mixed liquor of the nitric acid 10-300 (g/l) and the chlorides 1-30 (g/l) to perform electrolytic treatment on condition of the temperature of 35 ** - 65 ** and the current densities 1-30 (A/dm^2).

[0031]It is difficult to carry out passivation treatment for a short time, if nitric acid concentration is less than 10 g/l, and if it exceeds 300 g/l on the other hand, the evil in which a NO_X yield increases will start. If hydrochloric acid concentration is less than 1 g/l, it is difficult to carry out descaling at high speed, and if 30 g/l is exceeded, surface deterioration will happen. Let the treating solution of the nitrohydrochloric acid be the nitric acid 10-300 (g/l) from the above

Reason with mixed liquor with the chlorides 1-30 (g/l), and the mixed liquor which it is preferably with the nitric acid 50-200 (g/l) and the chloride 3-20 (g/l).

[0032]About the temperature of a nitrohydrochloric-acid solution, if it becomes difficult to process for a short time if temperature is less than 35 ** and it exceeds 65 **, evils, such as increase of a NO_X yield and surface deterioration, will be produced. As for the temperature of the treating solution of the above Reason to the nitrohydrochloric acid, 40-60 ** of 35-65 ** is preferably good.

[0033]Unless the electrolytic current density in the inside of a nitrohydrochloric-acid solution is less than 1A/dm^2, it cannot be processed in a short time, but if 30A/dm^2 is exceeded on the other hand, a NO_X yield will produce evils, such as increase and surface deterioration. the above Reason to current density -- 1-30 (A/dm^2) -- it is preferably considered as 5 - 25 A/dm^2. As for time required for the descaling treatment by the above monograph affair, it is preferred to carry out in 3 to 10 sec.

[0034]

[Example]

The stainless steel of the component composition shown in the working example 1 table 1 and Table 2 was ingoted, it cold-rolled after hot-rolling, annealing, and pickling, and the cold-rolled steel strip of board thickness 1.0 mm was obtained. With the monograph affair which shows this test specimen in Table 2, annealing, grinding, and pickling were performed and it investigated about corrosion resistance. Here, temperature up of the annealing pattern was carried out to 900 ** in the about 200 sec second, and it was made into air cooling after 900 **x60 sec maintenance. Grinding was performed using the brush made of nylon. Component composition also used the test specimen which separated from this invention range for comparison. Pitting potential (JIS G 0577) and a copper accelerated acetic acid salt spray test (JIS D0201) estimated the corrosion-resistant judgment. The result is combined with Table 3 and Table 4, and is shown.

[0035]

[Table 1]

化学成分 (wt%)

実験No.	C	Si	Mn	P	S	Cr	N	O	Al	Ti	Nb	Mo	Cu	Ni	W	Co	Ca	B
1	0.015	0.51	0.3	0.035	0.005	12.5	0.006	0.004	0.05	-	-	-	-	-	-	-	-	-
2	0.008	0.53	0.16	0.025	0.012	13	0.008	0.003	0.26	-	-	-	-	-	-	-	-	-
3	0.016	1.01	0.28	0.045	0.006	16.5	0.004	0.004	0.18	-	-	-	-	-	-	-	-	-
4	0.019	0.53	0.31	0.038	0.003	18	0.005	0.003	0.03	-	-	-	-	-	-	-	-	-
5	0.005	1.25	0.5	0.025	0.005	22.3	0.005	0.004	0.43	0.31	-	-	-	-	-	-	-	-
6	0.003	1.35	0.1	0.018	0.004	13.5	0.006	0.003	0.18	0.11	-	-	-	-	-	-	-	-
7	0.011	1.68	0.8	0.038	0.008	14.3	0.008	0.003	0.06	-	0.18	-	-	-	-	-	-	-
8	0.007	2.22	0.75	0.027	0.009	23.2	0.004	0.004	0.01	-	0.51	-	-	-	-	-	-	-
9	0.008	0.3	0.25	0.036	0.025	23.8	0.007	0.004	0.23	-	-	0.95	-	-	-	-	-	-
10	0.007	1.35	0.18	0.048	0.008	16.3	0.009	0.004	0.33	-	-	1.28	-	-	-	-	-	-
11	0.015	1.37	0.35	0.034	0.003	18.4	0.008	0.004	0.2	0.23	-	1.22	-	-	-	-	-	-
12	0.016	0.35	0.55	0.028	0.007	18.6	0.003	0.003	0.08	0.38	-	0.51	-	-	-	-	-	-
13	0.015	0.76	0.65	0.026	0.009	21.2	0.002	0.003	0.1	-	0.22	1.81	-	-	-	-	-	-
14	0.017	2.58	0.18	0.038	0.005	18.6	0.005	0.004	0.15	-	0.53	0.88	-	-	-	-	-	-
15	0.012	0.88	0.32	0.023	0.004	14.3	0.004	0.003	0.17	-	-	-	0.48	-	-	-	-	-
16	0.015	0.75	0.35	0.016	0.003	22.5	0.006	0.003	0.24	-	-	-	-	0.51	-	-	-	-
17	0.016	1.88	0.15	0.031	0.003	16.3	0.008	0.003	0.46	-	-	-	-	-	0.28	-	-	-
18	0.015	0.52	0.31	0.04	0.006	14.8	0.007	0.004	0.21	-	-	-	-	-	-	0.78	-	-
19	0.01	0.5	0.15	0.032	0.004	15.6	0.008	0.004	0.16	0.52	-	-	0.3	-	0.22	-	0.0056	-
20	0.008	0.51	0.2	0.028	0.008	11.3	0.005	0.004	0.03	-	0.38	1.25	-	0.32	-	0.38	-	0.001

[0036]

[Table 2]

化学成分 (wt%)

実験No.	C	Si	Mn	P	S	Cr	N	O	Al	Ti	Nb	Mo	Cu	Ni	W	Co	Ca	B
21	0.12	0.51	0.3	0.035	0.005	12.5	0.006	0.004	0.05	-	-	-	-	-	-	-	-	-
22	0.015	0.11	0.3	0.035	0.005	12.5	0.006	0.004	0.05	-	-	-	-	-	-	-	-	-
23	0.015	0.51	1.56	0.035	0.005	12.5	0.006	0.004	0.05	-	-	-	-	-	-	-	-	-
24	0.015	0.51	0.3	0.13	0.005	12.5	0.006	0.004	0.05	-	-	-	-	-	-	-	-	-
25	0.015	0.51	0.3	0.035	0.21	12.5	0.006	0.004	0.05	-	-	-	-	-	-	-	-	-
26	0.015	0.51	0.3	0.035	0.005	6.3	0.006	0.004	0.05	-	-	-	-	-	-	-	-	-
27	0.015	0.51	0.3	0.035	0.005	12.5	0.11	0.004	0.05	-	-	-	-	-	-	-	-	-
28	0.12	0.51	0.3	0.13	0.005	12.5	0.006	0.013	0.05	-	-	-	-	-	-	-	-	-
29	0.012	0.88	0.32	0.023	0.004	14.5	0.004	0.004	0.17	-	-	-	2.35	-	-	-	0.013	-
30	0.015	0.75	0.35	0.016	0.003	22.5	0.006	0.004	0.24	-	-	-	-	1.82	-	-	-	-
31	0.016	1.88	0.15	0.031	0.003	16.3	0.008	0.004	0.46	-	-	-	-	-	1.63	-	-	-
32	0.015	0.52	0.31	0.04	0.006	14.8	0.007	0.004	0.21	-	-	-	-	-	-	3.32	-	0.002

[0037]

[Table 3]

化学成分 (wt%)

実験No.	C	Si	Mn	P	S	Cr	N	O	Al	Ti	Nb	Mo	Cu	Ni	W	Co	Ca	B
33	0.008	1.25	0.31	0.021	0.015	24.2	0.008	0.004	0.25	-	-	-	-	-	-	-	-	-
34	0.007	1.26	0.33	0.02	0.016	24.1	0.006	0.004	0.24	-	-	-	-	-	-	-	-	-
35	0.008	1.24	0.32	0.02	0.015	24.1	0.007	0.003	0.26	-	-	-	-	-	-	-	-	-
36	0.008	1.25	0.33	0.021	0.015	24.2	0.007	0.004	0.25	-	-	-	-	-	-	-	-	-
37	0.008	1.24	0.33	0.02	0.014	24.3	0.006	0.004	0.25	-	-	-	-	-	-	-	-	-
38	0.018	0.31	0.65	0.035	0.005	12.5	0.006	0.003	0.07	0.23	-	-	0.46	-	-	-	-	-
39	0.018	0.32	0.64	0.036	0.006	12.4	0.005	0.003	0.08	0.22	-	-	0.45	-	-	-	-	-
40	0.017	0.32	0.65	0.035	0.005	12.5	0.006	0.003	0.08	0.24	-	-	0.46	-	-	-	-	-
41	0.019	0.31	0.64	0.037	0.005	12.5	0.006	0.004	0.08	0.22	-	-	0.45	-	-	-	-	-
42	0.018	0.31	0.66	0.035	0.005	12.4	0.006	0.003	0.08	0.23	-	-	0.46	-	-	-	-	-
43	0.013	0.56	0.43	0.01	0.007	18.2	0.008	0.004	0.45	-	0.38	0.94	-	0.32	0.22	-	-	0.0018
44	0.014	0.55	0.42	0.013	0.008	18.3	0.006	0.004	0.46	-	0.36	0.95	-	0.32	0.23	-	-	0.0018
45	0.013	0.54	0.44	0.012	0.008	18.3	0.007	0.004	0.45	-	0.37	0.94	-	0.32	0.21	-	-	0.0018
46	0.014	0.53	0.43	0.011	0.007	18.2	0.007	0.003	0.45	-	0.37	0.95	-	0.31	0.22	-	-	0.0018
47	0.014	0.55	0.43	0.012	0.008	18.1	0.006	0.004	0.45	-	0.37	0.95	-	0.32	0.22	-	-	0.0019
48	0.008	0.81	0.75	0.022	0.006	20.2	0.007	0.003	0.06	0.51	-	1.25	-	-	-	0.56	0.012	-
49	0.007	0.82	0.74	0.022	0.005	20.3	0.005	0.004	0.06	0.52	-	1.23	-	-	-	0.57	0.012	-
50	0.008	0.82	0.75	0.021	0.006	20.2	0.006	0.003	0.05	0.51	-	1.25	-	-	-	0.56	0.011	-
51	0.006	0.81	0.74	0.021	0.005	20.2	0.005	0.004	0.07	0.52	-	1.25	-	-	-	0.56	0.012	-
52	0.007	0.82	0.74	0.023	0.005	20.4	0.005	0.004	0.06	0.52	-	1.26	-	-	-	0.56	0.011	-

[0038]

[Table 4]

化学成分 (wt%)

実験No.	C	Si	Mn	P	S	Cr	N	O	Al	Ti	Nb	Mo	Cu	Ni	W	Co	Ca	B
53	0.008	1.25	0.31	0.021	0.015	24.2	0.008	0.004	0.25	-	-	-	-	-	-	-	-	-
54	0.007	1.26	0.33	0.02	0.016	24.1	0.006	0.004	0.24	-	-	-	-	-	-	-	-	-
55	0.008	1.24	1.32	0.02	0.015	24.1	0.007	0.003	0.26	-	-	-	-	-	-	-	-	-
56	0.008	1.25	0.33	0.021	0.015	24.2	0.007	0.003	0.25	-	-	-	-	-	-	-	-	-
57	0.018	0.31	0.65	0.035	0.005	12.5	0.006	0.004	0.07	0.23	-	-	0.46	-	-	-	-	-
58	0.018	0.32	0.64	0.036	0.006	12.4	0.005	0.004	0.08	0.22	-	-	0.45	-	-	-	-	-
59	0.017	0.32	0.65	0.035	0.005	12.5	0.116	0.003	0.08	0.24	-	-	0.46	-	-	-	-	-
60	0.119	0.31	0.64	0.037	0.005	12.5	0.006	0.014	0.08	0.22	-	-	0.45	-	-	-	-	-
61	0.013	0.56	0.43	0.01	0.007	18.2	0.008	0.004	0.45	-	0.38	0.94	-	0.32	0.22	-	-	0.0018
62	0.014	0.55	0.42	0.013	0.008	18.3	0.006	0.004	0.46	-	0.36	0.95	-	0.32	0.23	-	-	0.0018
63	0.013	0.54	0.44	0.012	0.008	18.3	0.007	0.004	0.45	-	0.37	0.94	-	0.32	0.21	-	-	0.0018
64	0.014	0.53	0.43	0.011	0.007	18.2	0.007	0.003	0.45	-	0.37	0.95	-	0.31	0.22	-	-	0.0019
65	0.008	0.81	0.75	0.022	0.006	20.2	0.007	0.003	0.06	0.51	-	1.25	-	-	-	0.56	0.012	-
66	0.007	0.82	0.74	0.022	0.005	20.3	0.005	0.004	0.06	0.52	-	1.23	-	-	-	0.57	0.012	-
67	0.008	0.82	0.75	0.021	0.006	20.2	0.006	0.004	0.05	0.51	-	1.25	-	-	-	0.56	0.011	-
68	0.006	0.81	0.74	0.021	0.005	20.2	0.005	0.004	0.07	0.52	-	1.25	-	-	-	0.56	0.012	-

[0039]According to the method of this invention, pickling time could carry out to a short time of less than 4 seconds, and Table 2 showed that the corrosion resistance after pickling was very good. this has an ingredient in an appropriate range -- in addition, concentration -- it is the

result of being carried out by stabilizing descaling including removal of a layer. On the other hand, it was shown by the comparative example which separated from the range of this invention that the corrosion resistance after pickling is inferior.

[0040]The stainless steel of the component composition shown in the working example 2 table 5 and Table 6 was ingoted, it cold-rolled after hot-rolling, annealing, and pickling, and the cold-rolled steel strip of board thickness 1.0 mm was obtained. With the monograph affair which shows this test specimen in Table 2, annealing, grinding, and pickling were performed and it investigated about corrosion resistance. Here, temperature up of the annealing pattern was carried out to 900 ** in the about 200 sec second, and it was made into air cooling after 900 **x60 sec maintenance. Grinding was performed using the brush made of nylon. Annealing and descaling conditions experimented also about what separated from this invention range for comparison. Pitting potential (JIS G 0577) and a copper accelerated acetic acid salt spray test (JIS D 0201) estimated the corrosion-resistant judgment. The result is combined with Table 7 and Table 8, and is shown.

[0041]

[Table 5]

実験No.	焼鈍雰囲気			研削量	酸洗条件					孔食電位 (mV)	発錆面積率 (%)	備考
	H2(%)	N2(%)	露点 (℃)	(μm)	硝酸(g/l)	塩酸(g/l)	液温 (℃)	電流密度(A/dm)	時間(sec)			
1	4	96	-35	0.2	150	10	45	20	2	234	4	本発明例
2	4	96	-35	0.2	150	10	45	20	2	238	2	本発明例
3	4	96	-35	0.2	150	10	45	20	2	252	3	本発明例
4	4	96	-35	0.2	150	10	45	20	2	261	3	本発明例
5	4	96	-35	0.2	150	10	45	20	2	303	1	本発明例
6	4	96	-35	0.2	150	10	45	20	2	265	1	本発明例
7	4	96	-35	0.2	150	10	45	20	2	256	3	本発明例
8	4	96	-35	0.2	150	10	45	20	2	332	4	本発明例
9	4	96	-35	0.2	150	10	45	20	2	683	0	本発明例
10	4	96	-35	0.2	150	10	45	20	2	723	0	本発明例
11	8	92	-45	0.5	80	4	55	10	4	803	0	本発明例
12	8	92	-45	0.5	80	4	55	10	4	758	0	本発明例
13	8	92	-45	0.5	80	4	55	10	4	822	0	本発明例
14	8	92	-45	0.5	80	4	55	10	4	801	0	本発明例
15	8	92	-45	0.5	80	4	55	10	4	323	3	本発明例
16	8	92	-45	0.5	80	4	55	10	4	381	2	本発明例
17	8	92	-45	0.5	80	4	55	10	4	303	1	本発明例
18	8	92	-45	0.5	80	4	55	10	4	293	2	本発明例
19	8	92	-45	0.5	80	4	55	10	4	278	3	本発明例
20	8	92	-45	0.5	80	4	55	10	4	585	0	本発明例

[0042]

[Table 6]

実験No.	焼鈍雰囲気			研削量	酸洗条件					孔食電位 (mV)	発錆面積率 (%)	備考
	H2(%)	N2(%)	露点 (℃)	(μm)	硝酸(g/l)	塩酸(g/l)	液温 (℃)	電流密度(A/dm)	時間(sec)			
21	4	96	-35	0.2	150	10	45	20	2	48	25	比較例
22	4	96	-35	0.2	150	10	45	20	2	56	22	比較例
23	4	96	-35	0.2	150	10	45	20	2	73	18	比較例
24	4	96	-35	0.2	150	10	45	20	2	24	28	比較例
25	4	96	-35	0.2	150	10	45	20	2	31	22	比較例
26	4	96	-35	0.2	150	10	45	20	2	19	43	比較例
27	4	96	-35	0.2	150	10	45	20	2	20	21	比較例
28	4	96	-35	0.2	150	10	45	20	2	69	23	比較例
29	8	92	-45	0.5	80	4	55	10	4	28	19	比較例
30	8	92	-45	0.5	80	4	55	10	4	14	18	比較例
31	8	92	-45	0.5	80	4	55	10	4	25	22	比較例
32	8	92	-45	0.5	80	4	55	10	4	30	16	比較例

[0043]

[Table 7]

実験No.	焼鈍雰囲気			研削量	酸洗条件					孔食電位 (mV)	発錆面積率 (%)	備考
	H2(%)	N2(%)	露点 (℃)	(μm)	硝酸(g/l)	塩酸(g/l)	液温 (℃)	電流密度(A/dm)	時間(sec)			
33	3	97	-35	0.2	150	10	45	20	2	304	2	本発明例
34	4	96	-25	0.3	100	6	35	10	2	302	3	本発明例
35	10	90	-15	0.5	30	7	55	13	2	286	3	本発明例
36	18	82	-45	0.8	130	3	50	5	2	313	1	本発明例
37	20	80	-55	0.6	60	5	45	8	2	258	4	本発明例
38	1	99	-45	0.5	80	4	55	10	4	270	4	本発明例
39	5	95	-55	0.2	120	25	45	20	4	282	2	本発明例
40	8	92	-25	0.1	60	3	35	22	4	248	2	本発明例
41	11	89	-35	0.6	50	18	65	6	4	289	3	本発明例
42	17	83	-40	0.3	200	2	60	3	4	298	2	本発明例
43	6	94	-45	0.3	60	8	50	3	5	789	0	本発明例
44	5	95	-35	0.2	120	6	45	8	5	803	0	本発明例
45	3	97	-40	0.1	80	5	55	12	5	801	0	本発明例
46	12	88	-30	0.2	30	4	45	8	5	783	1	本発明例
47	3	97	-45	0.5	40	8	60	11	5	811	0	本発明例
48	2	98	-40	0.3	120	6	50	15	3	724	1	本発明例
49	4	96	-35	0.4	160	7	35	3	3	763	1	本発明例
50	7	93	-55	0.8	140	14	40	1	3	718	2	本発明例
51	11	89	-45	0.1	50	26	45	5	3	703	1	本発明例
52	16	84	-15	0.6	250	2	55	18	3	793	0	本発明例
53	4	96	-35	0	150	10	45	20	2	23	43	比較例

[0044]

[Table 8]

実験No.	焼鈍雰囲気			研削量	酸洗条件					孔食電位 (mV)	発錆面積率 (%)	備考
	H2(%)	N2(%)	露点 (℃)	(μm)	硝酸(g/l)	塩酸(g/l)	液温 (℃)	電流密度(A/dm)	時間(sec)			
54	4	96	-35	0.01	150	10	45	20	2	43	38	比較例
55	4	96	-35	0	酸洗せず					0 以下	58	比較例
56	O_2 : 5%, N_2 : 95%			0.3	酸洗せず					0 以下	63	比較例
57	5	95	-45	0	80	4	55	10	4	53	24	比較例
58	5	95	-45	0	80	4	55	10	4	57	32	比較例
59	5	95	-45	0.5	酸洗せず					0 以下	68	比較例
60	O_2 : 5%, N_2 : 95%			0	中性塩電解→硝酸電解				50	76	22	比較例
61	3	97	-40	0	80	5	55	12	5	89	20	比較例
62	3	97	-40	0	80	5	55	12	5	83	17	比較例
63	O_2 : 5%, N_2 : 95%			0.1	80	5	55	12	5	0 以下	67	比較例
64	O_2 : 5%, N_2 : 95%			0	中性塩電解→硝酸電解				50	83	19	比較例
65	4	96	-40	0	120	6	50	15	3	79	23	比較例
66	4	96	-40	0	120	6	50	15	3	83	16	比較例
67	75	25	-55	0	酸洗せず					91	23	比較例
68	75	25	-55	0	硝酸電解				25	95	24	比較例

[0045]According to the method of this invention, pickling time could carry out to a short time of less than 5 seconds, and Table 4 showed that the corrosion resistance after pickling was very good. this -- concentration -- it is the result of being carried out by stabilizing descaling including removal of a layer. On the other hand, it was clearly shown by the comparative example which separated from the range of this invention that the corrosion resistance after pickling is inferior. When all of steel composition, annealing conditions, a mechanical cutting condition, and pickling conditions fulfill this invention range, it is clear from the above experiment that corrosion resistance's of a ferrite series stainless steel cold-rolled steel strip the characteristic which began and was excellent is shown.

[0046]

[Effect of the Invention]As mentioned above, according to this invention method, stable descaling becomes it is highly efficient and possible, and it becomes possible to improve the corrosion resistance after descaling remarkably. For this reason, according to this invention method, while the addition of the January the 15th of the lunar calendar matter for corrosion resistance can reduce conventionally, it becomes possible to manufacture the ferritic-stainless-steel belt of the outstanding quality by low cost.

[Translation done.]